REMARKS

Applicants' undersigned attorney thanks the Examiner for his comments. Applicants respectfully request reconsideration of this patent application, particularly in view of the above Amendment and the following remarks.

The present invention is directed to a thermal transfer roller having an outer cylindrical shell which contacts a substrate being heated or cooled, and an inner cylindrical shell which is coaxially positioned within the outer shell to define a continuous annulus between the inner cylindrical shell and the outer cylindrical shell through which heat transfer fluid may flow. A "continuous" annulus refers to an annulus having an uninterrupted or non-partitioned area in a circumferential direction, as shown in Fig. 1.

As shown in Figs. 1 and 2, the thermal transfer roller also includes a roll journal on one or both ends of the thermal transfer roller with a hollow passage extending along a central axis of the thermal transfer roller between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller. The passage transfers heat transfer fluid from the outlet end to the inlet end and is in fluidic communication with the annulus.

In one embodiment of this invention, the annulus includes a plurality of individual channels as shown in Fig. 3, separated by spiral walls, which carry heat transfer fluid through the annulus from an inlet end of the thermal transfer roller to

an outlet end of the thermal transfer roller. In this embodiment, the heat transfer fluid circulates around the annulus in a spiral flow pattern via the channels as the thermal transfer roller rotates, providing a substantially even fluid supply and distribution through the annulus.

Amendment to the Drawings

Applicants have amended Fig. 2 to consistently correspond to the specification as amended. The second occurrence of element reference number "20" was deleted and new element reference number "21" was added to reference the first (inlet) end.

Amendment to the Specification

Applicants have amended the specification to consistently name the elements of Applicants' claimed invention, namely the passage 24, the inlet channel 26, and the roll journals 32 and 42. This amendment is fully supported in the specification at page 4, lines 15-19, wherein it is stated:

> The heat transfer roller includes a roll journal on one or both ends provided with a passage for injecting and/or removing heat transfer fluid to and from the roller. A disk-shaped chamber is provided on one or both ends of the heat transfer roller for carrying heat transfer fluid between the corresponding roller journal and the annulus.

Applicants believe that the above Amendment adds no new matter to this Patent Application. It is readily apparent to one having ordinary skill in the art that the roll journal disclosed at Page 4, line 14 refers to element reference numbers 32 and 42 in Fig. 2 and that the passage disclosed at Page 4, line 16 refers to element reference number 24 in Figs. 1 and 2.

Amendment to the Claims

Applicants have amended independent Claims 1 and 14 to require that the inner shell be coaxially positioned within the outer shell to define a continuous annulus between an inner surface of the outer shell and an outer surface of the inner shell. Independent Claim 20 has been similarly amended to recite that the continuous annulus is defined by an inner surface of an outer cylindrical shell and an outer surface of an inner cylindrical shell. This amendment is fully supported in the specification at page 10, lines 3-7, at page 15, lines 15-19, and in Figs. 1 and 2.

Further, Applicants have amended independent Claims 1, 14 and 20 to require a passage in communication with the annulus and extending between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller. The passage initially transfers fluid from the outlet end to the inlet end. This amendment is fully supported in the specification at page 4, lines 15-19, at page 10, lines 12-16 and in Fig. 2.

Claim Objections - 37 C.F.R. 1.75

Claims 23 and 25 have been objected to under 37 C.F.R. 1.75 as being a substantial duplicate of Claims 22 and 24 respectively. Applicants respectfully transverse this objection. Dependent Claim 22 requires one thermal transfer roller of Claim 20 and a second transfer roller. The second transfer roller does not necessarily have to be a thermal transfer roller of Claim 20. Conversely, Claim 23 requires two thermal transfer rollers of Claim 20, thus requiring two identical thermal transfer rollers. Thus, Applicants urge that Claim 23 is not a substantial duplicate of Claim 22. Nor are Claims 22 and 23 otherwise so close in content as to cover the same thing

Similarly, dependent Claim 24 requires one thermal transfer roller of Claim 21 and a second transfer roller. The second transfer roller does not necessarily have to be a thermal transfer roller of Claim 21. Conversely, Claim 25 requires two thermal transfer rollers of Claim 21, thus requiring two identical thermal transfer rollers. Thus, Applicants urge that Claim 25 is not a substantial duplicate of Claim 24. Nor are Claims 24 and 25 otherwise so close in content as to cover the same thing. Therefore, Applicants respectfully request withdrawal of this objection.

Claim Rejections - 35 U.S.C. §102

The rejection of Claims 1-4, 8, 9, 14 and 18-21 under 35 U.S.C. §102(b) as being anticipated by Seanor, U.S. Patent 2,783,977 (Seanor), is respectfully traversed, particularly in view of the above Amendment and the

following remarks. Applicants' invention as claimed in amended independent Claims 1, 14 and 20 requires a continuous annulus defined by an inner surface of an outer shell and an outer surface of an inner shell. Further, Claims 1 and 14 require that the inner shell be coaxially positioned within the outer shell to define the continuous annulus. Thus, Applicants' invention requires both an outer shell 12 and an inner shell 14 which define the continuous annulus 16. As shown in Fig. 1, the annulus 16 is continuous about a periphery of the thermal transfer roller 10 between the inner surface of the outer shell 12 and the outer surface of the inner shell 14.

Additionally, the thermal transfer roller as claimed in amended independent Claims 1, 14 and 20 requires a passage in communication with the annulus and extending between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller. As shown in Fig. 2 and discussed in the specification at page 4, lines 15-19 and at page 10, lines 12-16, the passage 24 transfers fluid through the center of the thermal transfer roller 10 from the outlet end 22 to the inlet end 21. These novel claim limitations are disclosed throughout Applicants' specification, but are not taught or suggested in Seanor.

The heat exchanger of Seanor comprises "a fabricated metal roll or drum 2 which has a plurality of longitudinally directed, circumferentially spaced holes 3 extending the length thereof. The roll 2 has a bore 4 therein and it has counterbored ends 5 that connect to the holes 3 at the ends thereof." See Seanor at

Col. 2, lines 54 through 59. Thus, the heat exchanger of Seanor comprises one drum 2 having holes 3 which align with the bores formed in the counterbored ends 5. The longitudinally directed holes 3 are best shown in Fig. 4 of Seanor. **At the lower right-hand corner of Fig. 4, a partial cross-sectional view of the drum 2 clearly shows the longitudinally directed holes 3.** Seanor does not disclose an outer shell and a coaxially positioned inner shell which form or define a continuous annulus therebetween, as required by Applicants' claimed invention. Seanor discloses a heat exchanger wherein the heat exchange fluid flows through discrete holes, such as holes 3a and 3b, which are circumferentially spaced about the inner end plate 9. Thus, the heat exchange fluid is not evenly distributed about the periphery of the drum and cannot provide uniform heat transfer.

Further, unlike Applicants' claimed invention, Seanor does not disclose a passage which extends along a central axis of the heat exchanger to transfer heat transfer fluid from one end of the heat exchanger to the opposite end of the heat exchanger.

Applicants urge that the above Amendment and remarks overcome the rejection of Claims 1-4, 8, 9, 14 and 18-21 under 35 U.S.C. §102(b) as being anticipated by Seanor. Thus, Applicants respectfully request withdrawal of this rejection.

Claim Rejections - 35 U.S.C. §103

The rejection of Claims 5-7, 10-12, 15-17 and 22-25 under 35 U.S.C. §103 as being unpatentable over Seanor is respectfully traversed, particularly in view of the above Amendment and the following remarks.

Claims 5-7 and 10-12 ultimately depend from and further limit independent Claim 1, which Applicants believe is patentable for the reasons presented above. Claims 15-17 ultimately depend from and further limit independent Claim 14, which Applicants believe is patentable for the reasons presented above.

Claims 5-7, 10-12 and 15-17 recite 10, 20 and 30 channels in the embodiment of the respective independent Claim from which they depend. As set forth above, contrary to the Examiner's assertion, Seanor does not teach or suggest important claimed features of the present invention regardless of the claimed number of channels.

Claims 22-25 ultimately depend from and further limit independent Claim 20, which Applicants believe is patentable for the reasons presented above. Seanor does not teach or suggest important claimed features of the present invention as claimed in amended Claim 20 regardless of the number of rollers claimed in Claims 22, 23, 24 and 25.

Applicants urge that the above Amendment and remarks overcome the rejection of Claims 5-7, 10-12, 15-17 and 22-25 under 35 U.S.C. §103 as being

unpatentable over Seanor. Thus, Applicants respectfully request withdrawal of this rejection.

The rejection of Claim 13 under 35 U.S.C. §103 as being unpatentable over Seanor in view of Eriksen et al., U.S. Patent 5,590,704, is respectfully traversed, particularly in view of the above Amendments and the following remarks.

Claim 13 depends from and further limits Claim 1, which Applicants believe is patentable for the reasons presented above. It would not have been obvious at the time this invention was made to a person having ordinary skill in the art to employ in Seanor a spiral fluid flow channel for the purpose of reducing flow resistance as disclosed in Eriksen et al.

Applicants urge that the above remarks overcome the rejection of Claim 13 under 35 U.S.C. §103 as being unpatentable over Seanor in view of Eriksen et al. Thus, Applicants respectfully request withdrawal of this rejection.

CONCLUSION

Applicants intend to be fully responsive to the outstanding Office Action. If the Primary Examiner detects any issue which the Primary Examiner believes Applicants have not addressed in this response, Applicants urge the Primary Examiner to contact the undersigned.

Applicants sincerely believe that this patent application is now in condition for allowance and, thus, respectfully request early allowance.

Respectfully submitted,

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MARKED-UP VERSION SHOWING CHANGES MADE

In the Specification:

At Page 4, lines 8-19:

The thermal transfer rollers may be heating or cooling rollers, and may operate using hot or cold thermal transfer fluids. Generally, the thermal transfer rollers will include an outer cylindrical shell which contacts the nonwoven web or other substrate being heated or cooled, an inner cylindrical shell, and an annulus between the inner and outer cylindrical shells through which heat transfer fluid may flow. The annulus may be entirely open (free of individual channels), or may include a plurality of individual channels which carry heat transfer fluid from one end to the other of the heat transfer roller. The heat transfer roller includes a roll journal on one or both ends provided with a passage for injecting and/or removing heat transfer fluid to and from the roller. A disk-shaped chamber is provided on one or both ends of the heat transfer roller for carrying heat transfer fluid between the corresponding [roller] <u>roll</u> journal and the annulus.

At page 10, line 12 through page 13, line 8:

Referring to Fig. 2, a hollow [roller journal] <u>passage</u> 24 extends along a central axis of the thermal transfer roller 10, and communicates at one end with [a supply line] <u>an inlet channel</u> 26 for heat transfer fluid, which supplies fluid to the

[journal] passage 24 as shown by the arrows. In the embodiment shown, the [journal] passage 24 initially carries the fluid through the center of the roller [from the second end 22 to the first end 20] from the second end 22 to the first end 21 thereof. A first disk-shaped chamber 28 at the first end 20 of the roller is defined between inner roller wall 30, first [roller end cap] roll journal 32, and the cylindrical annulus 16. The first disk-shaped chamber 28, which is a fluid inlet chamber, carries heat transfer fluid from the [journal] passage 24 to the annulus 16, via a cylindrical fluid entry slot 34 (Fig. 2), or a plurality of smaller, individual fluid entry openings 35 (Fig. 1) formed in the inner cylindrical shell 14. The heat transfer fluid from inlet chamber 28 passes into and through the annulus 16 as the roller 10 is rotating, sometimes at high velocity, whereupon the heat transfer fluid heats (or cools) the outer cylindrical shell 12, which in turn conducts and transfers the heat (or cooling) to a substrate. In the embodiment shown, the heat transfer fluid circulates around the annulus 16 in a spiral flow pattern via channels 18.

The heat transfer fluid then exits the annulus 16 via a cylindrical fluid exit slot 36 (or a plurality of smaller openings 35) in the inner shell 14, and enters a second disk-shaped chamber 38, which is defined between inner roller wall 40, second [end cap] roll journal 42, and the cylindrical annulus 16. The second disk-shaped chamber 38, which is a fluid outlet chamber, carries the spent heat transfer fluid to a cylindrical exit channel 44, which is defined between the second [end cap]

roll journal 42 and the wall of cylindrical inlet channel 26. The exit channel 44 carries the fluid to a heating or cooling device (not shown), which heats or cools the fluid as needed, for further use via the inlet channel 26.

Referring to Fig. 1, at least one end chamber 28 or 38 (and preferably both end chambers) is provided with a plurality of channels 46 between the [journal] passage 24 and the annulus 16. Each channel 46 has a wider end approaching the inner shell 14 and annulus 16, and a narrower end closer to the [journal] passage 24. The purpose of channels 46 is to substantially prevent the heat transfer fluid from assuming an angular or spiral flow pattern within the end chamber, particularly within the inlet chamber 28, due to rotation of the roller. Angular flow patterns in the end chambers (particularly inlet chamber 28) cause increased fluid pressure and reduce the volume of fluid delivered by a typical constant-pressure fluid pump. The tendency for angular or spiral fluid flow increases with roller velocity, causing further pressure increase and further reduction in fluid volume. By substantially reducing angular or spiral flow within the end chambers, the drop in fluid volume (and heat transfer) at higher roller velocities is substantially diminished.

The channels 46 are also designed to facilitate a substantially uniform, even discharge of fluid into cylindrical slot 34 entering the annulus 16 (Fig. 2) or into numerous smaller openings 35 entering the annulus 16 (Fig. 1). This is accomplished in part by providing channels 46 with a wider end approaching the annulus, and a

narrower end approaching the [journal] passage 24. This configuration permits the channels to be immediately adjacent or very close to each other at both ends, and minimizes the amount of space not occupied by channels. By minimizing the distance between adjacent channels approaching the annulus, a substantially even fluid discharge around the circumference of the annulus is maintained.

In a preferred embodiment, the adjacent channels 46 are separated by relatively thin walls 48 which do not increase in thickness between their inner ends 50 near the [journal] passage 24 and their outer ends 52 near the annulus 16. For instance, the outer ends 52 of walls 48 may be connected by an imaginary line, which may be a circle. The imaginary line connecting the ends 52 should be occupied at least 70% by channels 46 and not more than 30% by walls 48 between the channels. Preferably, the imaginary line (defined in Fig. 1 by the inner surface of inner shell 14) will be occupied at least 80% by channels 46 and not more than 20% by walls 48, more preferably at least 90% by channels 46 and not more than 10% by thin walls 48.

In the preferred embodiment illustrated in Fig. 1, the walls 48 extend radially outward in the disk-shaped end chamber, from first ends 50 near the [journal]passage 24 to second ends 52 touching the inner shell 35 and approaching the annulus. The walls 48 and channels 46 can be provided in the form of a single-piece baffle assembly having a back plate 54 mounted to an inner wall of the end chamber by a plurality of fasteners 56. The walls 48 are provided by baffles which

are mounted to the back plate 54, to provide the single-piece assembly which can be easily inserted, removed, and replaced in the end chamber.

In the Claims:

1. (Amended) A thermal transfer roller, comprising:

an outer shell[, an inner shell, and an annulus] and an inner shell coaxially positioned within the outer shell to define a continuous annulus between an inner surface of the outer shell and an outer surface of the inner shell [between the outer and inner shells];

at least an inlet end chamber in fluid communication with the annulus;

a [roller journal] passage in communication with the annulus, the passage extending between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller; and

a plurality of inlet channels in the inlet end chamber, each inlet channel having a first end closer to the [roller journal] passage and a second end closer to the annulus;

wherein each inlet channel becomes progressively wider along a plane which includes a circumference of the inlet end chamber between the first end and the second end thereof.

14. (Amended) A thermal transfer roller, comprising:

an outer shell[, an inner shell, and an annulus] and an inner shell coaxially positioned within the outer shell to define a continuous annulus between an inner surface of the outer shell and an outer surface of the inner shell [between the outer and inner shells];

an inlet end chamber positioned at an inlet end of the thermal transfer roller and in communication with the annulus;

[a roller journal in communication with the inlet end chamber;]

a plurality of inlet channels in the inlet end chamber, each having a wider end closer to the annulus and a narrower end further away from the annulus, wherein each inlet channel becomes progressively wider along a plane which includes a circumference of the inlet end chamber between the narrower end and the wider end thereof;

an outlet end chamber positioned at an outlet end of the thermal transfer roller and in communication with the annulus; [and]

a plurality of outlet channels in the outlet end chamber, each having a wider end closer to the annulus and a narrower end further away from the annulus, wherein each outlet channel becomes progressively wider along a plane which includes a circumference of the outlet end chamber between the narrower end and the wider end thereof; and

a passage in communication with the annulus, the passage extending between the inlet end of the thermal transfer roller and the outlet end of the thermal transfer roller.

20. (Twice Amended) A thermal transfer roller, comprising:

an inlet end chamber in communication with a source of fluid;

[an] a continuous annulus in communication with the inlet end chamber, the continuous annulus [formed between] defined by an inner surface of an outer cylindrical shell and an outer surface of an inner cylindrical shell; [and]

a plurality of inlet channels in the inlet end chamber, each inlet channel having a wider end closer to the annulus, and a narrower end, wherein adjacent inlet channels are separated by a wall having a substantially uniform thickness; and

a passage in communication with the annulus, the passage extending between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller.

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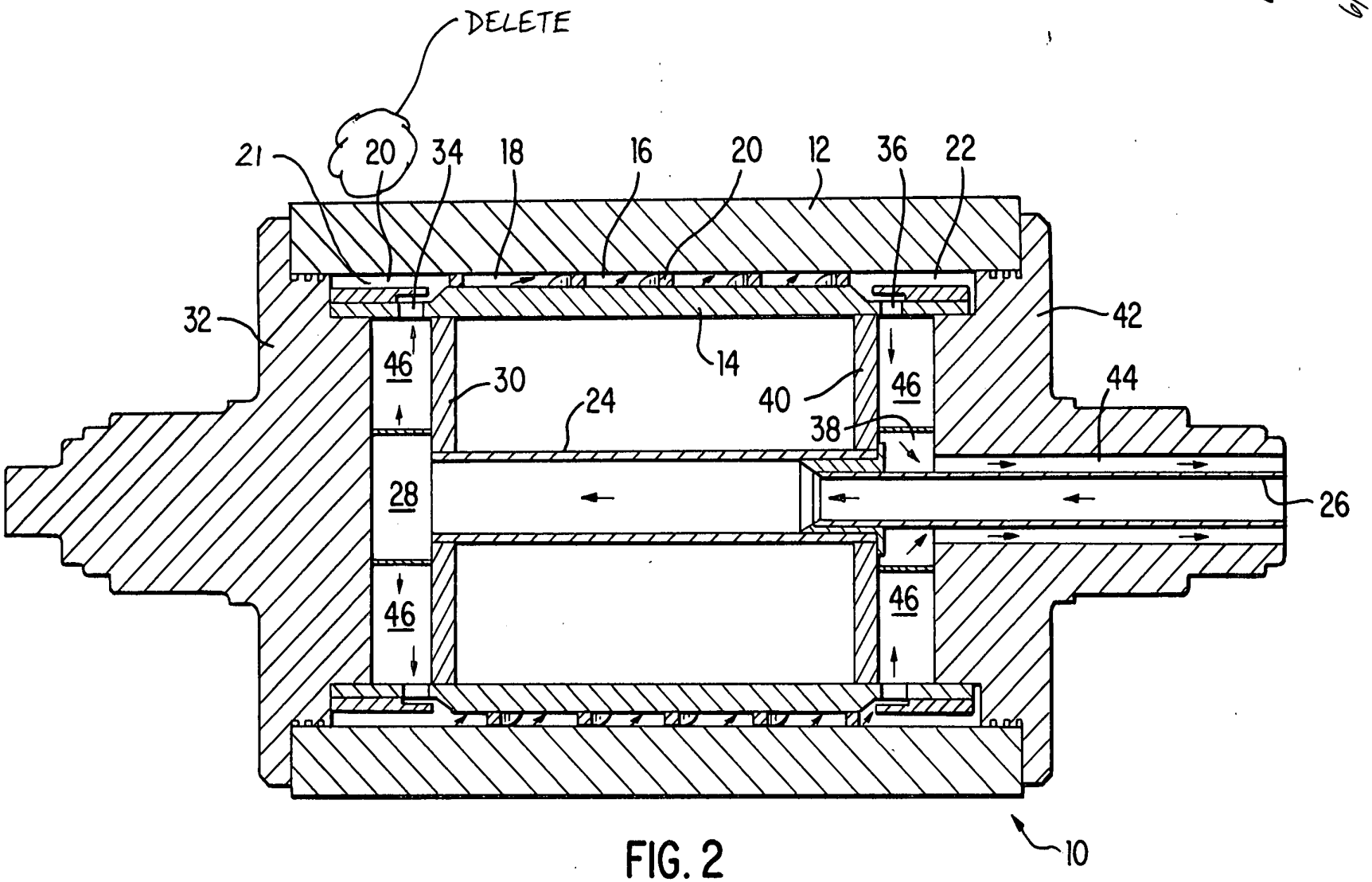

FIG. 2